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**METRIC**  
MIL-PRF-24635B(SH)  
30 June 1994  
SUPERSEDING  
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(See 6.10)

## PERFORMANCE SPECIFICATION

### ENAMEL, SILICONE ALKYD COPOLYMER (METRIC)

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers copolymerized silicone alkyd enamels for use on primed, smooth metal, glass reinforced plastic (GRP), wood and plastic/composite surfaces.

1.2 Classification. Enamel covered by this specification shall be an air-drying, silicone alkyd resin enamel furnished in the following types and classes as specified (see 6.1 and 6.2):

Type I - Volatile organic content (VOC) not greater than 420 grams per liter (g/L; 3.5 pounds per gallon [lb/gal]).  
Type II - VOC not greater than 340 g/L (2.8 lb/gal).  
Type III - VOC not greater than 275 g/L (2.3 lb/gal).

Class 1 - High gloss, 85 percent minimum.  
Class 2 - Medium gloss, 45 to 60 percent.  
Class 3 - Low gloss, 15 to 30 percent.  
Class 4 - Flat gloss, 5 to 15 percent.

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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, SEA 03R42, Naval Sea Systems Command, 2531 Jefferson Davis Hwy., Arlington, VA 22242-5160 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

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DTIC QUALITY INSPECTED 1

## 2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

## SPECIFICATIONS

## FEDERAL

TT-P-645	- Primer, Paint, Zinc-Molybdate, Alkyd Type.
TT-T-291	- Thinner, Paint, Mineral Spirits, Regular or Odorless.
PPP-F-320	- Fiberboard, Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes.
PPP-P-1892	- Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing and Marking of.

## MILITARY

MIL-L-19140	- Lumber and Plywood, Fire-Retardant Treated.
MIL-P-24441/20	- Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III
MIL-P-24441/29	- Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type IV

## STANDARDS

## FEDERAL

FED-STD-141	- Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing.
FED-STD-313	- Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.
FED-STD-595	- Colors Used in Government Procurement.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, BLDG. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

## PUBLICATIONS

## ENVIRONMENTAL PROTECTION AGENCY (EPA)

40 Code of Federal Regulations (CFR) ch.1, part 60, appendix A, method 24 - Determination of Volatile Matter Content, Water Content, Density, Volume Solids and Weight Solids of Surface Coatings.

EPA (Continued)

40 CFR part 261, Appendix II

Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846 (NSN 955-001-00000-1)

Methods for Chemical Analysis of Water and Waste, EPA-600/4-020, USEPA, 1979

Federal Register, Volume 47, Number 103, Appendix A, pages 23376-23389, May 7, 1982

DEPARTMENT OF LABOR

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

29 CFR Parts 1910, 1915, 1917, 1918, 1926 and 1928 - Hazard Communication Act, Final Rule.

(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS  
(ACGIH)

Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices.

(Application for copies should be sent to the American Conference of Governmental Hygienists, 6500 Glenway Avenue, Bldg D7, Cincinnati, Ohio 45211.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 95 - Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation
- D 523 - Standard Test Method for Specular Gloss. (DoD adopted)
- D 562 - Standard Test Method for Consistency of Paints Using the Stormer Viscometer. (DoD adopted)
- D 563 - Standard Test Method for Phthalic Anhydride Content of Alkyd Resins and Resin Solutions. (DoD adopted)
- D-609 - Standard Methods for Preparation of Steel Panels for Testing Paint, Varnish, Lacquer, and Related Products
- D 660 - Standard Test Method for Evaluating Degree of Checking of Exterior Paints. (DoD adopted)
- D 661 - Standard Test Method for Evaluating Degree of Cracking of Exterior Paints. (DoD adopted)
- D 714 - Standard Test Method for Evaluating Degree of Blistering of Paints. (DoD adopted)

## ASTM (Continued)

D 823 - Standard Test Methods for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels. (DoD adopted)

D 1014 - Standard Test Method for Conducting Exterior Exposure Tests of Paints on Steel. (DoD adopted)

D 1210 - Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems. (DoD adopted)

D 1296 - Standard Test Method for Odor of Volatile Solvents and Diluents. (DoD adopted)

D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes. (DoD adopted)

D 1364 - Standard Test Method for Water in Volatile Solvents (Fischer Reagent Titration Method).

D 1398 - Standard Test Method for Fatty Acid Content of Alkyd Resins and Alkyd Resin Solutions. (DoD adopted)

D 1542 - Standard Test Method for Qualitative Detection of Rosin in Varnishes. (DoD adopted)

D 1849 - Standard Test Method for Package Stability of Paint. (DoD adopted)

D 1983 - Standard Test Method for Fatty Acid Composition by Gas-Liquid Chromatography of Methyl Esters. (DoD adopted)

D 2244 - Standard Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates. (DoD adopted)

D 2245 - Standard Method for Identification of Oils and Oil Acids in Solvent-Reducible Paints. (DoD adopted)

D 2369 - Standard Test Method for Volatile Content of Coatings.

D 2698 - Standard Test Method for Determination of the Pigment Content of Solvent-Reducible Paints by High-Speed Centrifuging. (DoD adopted)

D 2800 - Standard Test Method for Preparation of Methyl Esters from Oils for Determination of Fatty Acid Composition by Gas-Liquid Chromatography. (DoD adopted)

D 2805 - Standard Test Method for Hiding Power of Paints by Reflectometry.

D 3278 - Standard Test Method for Flash Point of Liquids by Setaflash Closed-Cup Apparatus. (DoD adopted)

D 4214 - Standard Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.

E 97 - Standard Test Method for Directional Reflectance Factor, 45-deg, 0-deg of Opaque Specimens by Broad-Band Filter Reflectometry. (DoD adopted)

E 1252 - Standard Practice for General Techniques for Qualitative Infrared Analysis.

F 718 - Standard Shipbuilders and Marine Paints and Coatings Product/Procedure Data Sheet. (DoD adopted)

G 53 - Standard Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Qualification. The enamels furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) at the time of award of contract (see 4.2 and 6.4).

3.2 Composition. The manufacturer is given his choice of ingredients used in the formulation of the enamels described in this document. However, enamel shall conform to all the requirements of this specification.

3.2.1 Metal content. The content of each soluble metal and total content of each metal of the enamel shall be not greater than the values listed in tables I and II when tested in accordance with 4.6.20.

TABLE I. Soluble metals content.

Soluble metal and/or its compound	Maximum, mg/L
Antimony and/or its compounds	15
Arsenic and/or its compounds	5
Barium and/or its compounds (excluding barite)	100
Beryllium and/or its compounds	0.75
Cadmium and/or its compounds	1
Chromium (VI) compounds	5
Chromium and/or its chromium (III) compounds	560
Cobalt and/or its compounds	80
Copper and/or its compounds	25
Fluoride salts	180
Lead and/or its compounds	5
Mercury and/or its compounds	0.2
Molybdenum and/or its compounds	350
Nickel and/or its compounds	20
Selenium and/or its compounds	1
Silver and/or its compounds	5
Tantalum and/or its compounds	100
Thallium and/or its compounds	7
Tungsten and/or its compounds	100
Vanadium and/or its compounds	24
Zinc and/or its compounds	250

TABLE II. Total metals content.

Metal	Maximum, %wt
Antimony and/or its compounds	0.015
Arsenic and/or its compounds	0.001
Barium and/or its compounds (excluding barite)	0.10
Beryllium and/or its compounds	0.0002
Cadmium and/or its compounds	0.0005
Chromium (VI) compounds	0.0005
Chromium and/or its chromium (III) compounds	0.56
Cobalt and/or its compounds	0.005
Copper and/or its compounds	0.01
Fluoride salts	0.18
Lead and/or its compounds	0.005
Mercury and/or its compounds	0.0002
Molybdenum and/or its compounds	0.35
Nickel and/or its compounds	0.02
Selenium and/or its compounds	0.001
Silver and/or its compounds	0.001
Tantalum and/or its compounds	0.100
Thallium and/or its compounds	0.007
Tungsten and/or its compounds	0.100
Vanadium and/or its compounds	0.01
Zinc and/or its compounds	0.25

3.2.2 Hazardous air pollutants (HAPs). The content of HAPs solvents in the total enamel shall be not greater than the weight percent (%WT) values listed in table III when tested in accordance with 4.6.23.

TABLE III. Hazardous solvent content.

Hazardous solvent in total enamel	Maximum, %WT
Benzene	0.05
Chlorinated solvent(s), total	0.05
Carbon tetrachloride	
Chloroform (Trichloromethane)	
Methylene chloride (Dichloromethane)	
Tetrachloroethylene (Perchloroethylene)	
1,1,1-Trichloroethylene (Methyl chloroform)	
Trichloroethylene	
Ethyl benzene	0.05
Methyl, ethyl and butyl mono-ethers of	0.05
Ethylene glycol or the acetates, total	
(Methyl, Ethyl and Butyl Cellosolves and acetates)	
Methyl ethyl ketone (MEK)	0.05
Methyl isobutyl ketone (MIBK)	0.05
Toluene	0.05
Xylene (all forms), total	0.1

3.3 Color. The color shall be characteristic of the pigments used and shall match the following as specified (see table VII and 4.6.7):

(a) Colors defined by Tristimulus values shall match the following when measured in accordance with 4.6.7:

<u>Colors defined by tristimulus values</u>	Tristimulus values		
	<u>L</u>	<u>a</u>	<u>b</u>
Navy Haze Gray No. 27	+56.0	-1.83	-1.37

(b) All other colors shall match the FED-STD-595 number specified in table VII when measured in accordance with 4.6.7.

3.3.1 Color deviation. The color deviation of the paint shall be obtained as specified in 4.6.7. The measured color deviation terms [Delta ( $\Delta$ )E,  $\Delta$  A,  $\Delta$  B,  $\Delta$  L] from the appropriate Haze Gray No. 27 [see 3.3 (a)] or specified FED-STD-595 color card in Commission Internationale de l'Eclairage (CIE; International Commission on Illumination) LAB units shall be not greater than the CIELAB units listed below as either positive or negative (+ or -) values:

<u>Colors defined by tristimulus values</u>	Color Deviation values			
	$\Delta E$	$\Delta A$	$\Delta B$	$\Delta L$
Navy Haze Gray No. 27	0.5	0.3	0.3	0.3

<u>FED-STD-595 COLOR No.</u>	Color Deviation values			
	$\Delta E$	$\Delta A$	$\Delta B$	$\Delta L$
26173, 26373	0.5	0.3	0.3	0.3
36173, 36270, 36373	0.5	0.3	0.3	0.3
All other colors	1.8	1.0	1.0	1.0

3.4 Vehicle resin. The vehicle shall consist of a copolymerized, air-drying, silicone modified long oil soya alkyd conforming to the requirements of table IV (see table VI).

TABLE IV. Characteristics of vehicle.<sup>1/</sup>

Characteristics	Requirements	
	Minimum	Maximum
Silica ( $\text{SiO}_2$ ) percent by weight of nonvolatile vehicle	14.7	--
Phthalic anhydride, percent by weight of nonvolatile vehicle	14	17
Drying oil acids, percent by weight of nonvolatile vehicle	41	47
Soya oil	Positive	
Rosin	Negative	
Phenolic resin	Negative	

1/ Tests shall be as specified in table VI.

3.4.1 Identification. The copolymer shall give two similar spectra, both of which shall have the significant bands of both the alkyd and silicone resins as shown on figure 1. Neither spectra shall show an absorption band in the 13.9 to 14.0 micrometer ( $\mu\text{m}$ ) region and both shall show a sharp narrow band at 7.0  $\mu\text{m}$  (see 4.6.15.2).

### 3.5 Qualitative requirements.

3.5.1 Condition in container. The enamel shall be free of grit, seeds, skins, lumps or livering, and shall show no more surface float (separated pigments or other ingredients on the surface of the liquid enamel) or pigment settling or caking than can be readily re-incorporated to a smooth uniform state with a paddle or mechanical mixer within 5 minutes (see 4.6.1). When tested in accordance with 4.6.7, the CIELAB color difference of the mixed enamel shall meet the requirements of 3.3 and 3.3.1. After a standing period of 2 hours without further mixing, the CIELAB color difference of the enamel shall again be tested in accordance with 4.6.7. The CIELAB color difference measured for 2 hour old mixed enamel shall be not greater than 0.5 CIELAB units from the color values measured after stirring, but before the 2 hour standing period.

### 3.5.2 Storage stability.

3.5.2.1 Partially-full container. The enamel shall show no skinning (see 4.6.2.1). After aging as specified in 4.6.2.1, the enamel shall show no surface float (separated pigments or other ingredients on the surface of the liquid enamel), livering, curdling, hard caking or gummy sediment. The enamel shall mix readily to a smooth uniform state within 5 minutes when mixed with a paddle or mechanical mixer and shall have a consistency not greater than 5 units from the original Kreb unit consistency before testing (see table VI). Enamel shall meet

all other requirements of this specification. When tested in accordance with 4.6.7, the CIELAB color difference of the mixed enamel shall be not greater than 0.5 CIELAB units from the original color values measured prior to the shelf life test. The mixed enamel shall also meet the requirements of 3.5.13.

3.5.2.2 Full container. When tested in accordance with 4.6.2.2, the enamel shall show no skinning, livering, curdling, hard caking or gummy sediment. The enamel shall mix to a smooth uniform state with no surface float (separated pigments or other ingredients on the surface of the liquid enamel) within 5 minutes when mixed with a paddle or mechanical mixer and shall have a consistency not greater than 5 units from the original Kreb unit consistency before testing (see table VI). Enamel shall meet all other requirements of this specification. When tested in accordance with 4.6.7, the CIELAB color difference of the mixed enamel shall be not greater than 0.5 CIELAB units from the original color values measured prior to the shelf life test. The mixed enamel shall also meet the requirements of 3.5.13.

3.5.2.3 Accelerated storage stability. When tested in accordance with 4.6.2.3, a previously unopened, original container of enamel shall be re-dispersable within 5 minutes with a paddle or mechanical mixer to a uniform condition and shall be in accordance with the requirements of 3.5.4, 3.5.5 and 3.5.6. When tested in accordance with 4.6.7, the CIELAB color difference of the mixed enamel shall be not greater than 0.5 CIELAB units from the original color values measured prior to the shelf life test. The mixed enamel shall also meet the requirements of 3.5.13, when the color difference is calculated using as the original color that obtained for the 1 year storage test sample.

3.5.3 Dilution stability. When thinned as specified in 4.6.3, the enamel shall remain stable and uniform, showing no precipitation or curdling. Slight pigment settling shall be permitted. Thinning shall not cause the VOC of any type to be exceeded.

3.5.4 Brushing properties. The enamel shall brush satisfactorily and shall dry to a uniform film, free from seeds, runs, sags or streaks (see 4.6.4).

3.5.5 Rolling properties. The enamel shall roll satisfactorily and shall dry to a uniform film, free from seeds, runs, sags or streaks. The dried film shall show an even, smooth finish (see 4.6.5).

3.5.6 Spraying properties. The enamel shall spray satisfactorily and shall show no running, sagging, streaking or orange peel. The air-dried film shall show no seeding, dusting, floating, fogging, mottling, hazing, or other film defects (see 4.6.6).

3.5.7 Odor. The odor of the wet enamel and the film at any interval of drying shall not be obnoxious or objectionable (see 4.6.8).

3.5.8 Anchorage. A film of the enamel shall show no removal or loosening of the enamel beyond 1.6 millimeters (mm) (0.063 inch) on either side of the score line (see 4.6.9).

3.5.9 Flexibility. A film of enamel shall bend without cracking or flaking (see 4.6.10).

3.5.10 Flake and crack resistance. A film of enamel shall adhere tightly to the metal and shall not flake or crack. The film shall ribbon or curl from the metal on cutting, and the cut shall show beveled edges (see 4.6.11).

3.5.11 Recoating. Recoating of a dried film shall produce no film irregularities. The enamel shall not wrinkle or lift the first coat and shall dry to a smooth, uniform finish (see 4.6.12).

3.5.12 Water resistance. A film of enamel shall show no blistering or wrinkling when examined immediately after removal from distilled water. When examined, 2 hours after removal, there shall be no softening, whitening or dulling. After 24 hours of air-drying, the portion of the panel which was immersed shall be indistinguishable with regard to hardness, adhesion and general appearance from a panel prepared at the same time but not immersed, and shall retain at least 90 percent of the 60-degree specular gloss of the comparison panel (see 4.6.13).

3.5.13 Accelerated weathering. Films of the enamel shall show no evidence of chalking and a loss of not greater than 35 percent of the gloss measured prior to exposure (see 4.6.18). The color difference ( $\Delta E$ ) shall be not greater than a value of 1.0 CIELAB units from the original pre-test standard value. After testing  $\Delta L$ ,  $\Delta a$  and  $\Delta b$ , respectively, shall be not greater than plus or minus 1.0 CIELAB unit from the original pre-test standard value when measured as specified (see 4.6.7).

3.5.14 Long term exterior exposure. When tested in accordance with 4.6.21, films of the enamel shall meet the following requirements:

- (a) 60° Gloss not less than 50% of that measured prior to testing,
- (b) Chalking shall be rated not less than number 8 of figure 2,
- (c) Checking shall be rated not less than 9 (1%),
- (d) Cracking shall be rated not less than 9,
- (e) Blistering shall be rated not less than 10, and
- (f) When CIE color values of the exposed test panels are compared to the original CIE color values of the test panel, the ASTM D 2244 color difference calculated values shall conform to the following:
  - (1)  $\Delta E$  shall be not greater than 1.0 CIELAB units,
  - (2)  $\Delta A$  shall be not greater than  $\pm 1.0$  CIELAB unit,
  - (3)  $\Delta B$  shall be not greater than  $\pm 1.0$  CIELAB unit and
  - (4)  $\Delta L$  shall be not greater than  $\pm 1.0$  CIELAB unit.

3.6 Quantitative requirements. The enamels shall conform to the requirements of table V when tested in accordance with table VI.

TABLE V. Quantitative requirements of the enamel. 1/

Characteristics	Requirements	
	Minimum	Maximum
Flash point, Pensky-Martens, closed cup, degrees Celsius (°C) (degrees Fahrenheit (°F))	38(100)	--
Water, percent by weight of enamel	--	0.5 <sup>2/</sup>
Coarse particles and skins (retained on number 325 mesh) percent by weight of pigment	--	0.5
Consistency, Krebs-Stormer, shearing rate, equivalent Krebs units	--	100
Fineness of grind	6	--
Drying time:		
Set-to-touch, hours	--	2
Dry hard, hours	--	8
Asbestos	None	
Lead content (as metal), percent	--	0.06
VOC, g/L		
Type I	--	420
Type II	--	340
Type III	--	275
Gloss (60 degrees specular)		
Class 1	85	--
Class 2	45	60
Class 3	15	30
Class 4	5	15
Contrast ratio		
Gray and black colors	0.90	--
White colors	0.90	--
Red, yellow and orange colors	0.75	--
All other colors	0.80	--

1/ Tests shall be as specified in table V.

2/ Applies only to solvent based silicone alkyd copolymer enamels. Does not apply to silicone alkyd copolymer enamels which are water emulsion, water based, water thinned or which use water as a solvent.

3.7 Label. Manufacturer shall prepare container label instructions for the enamel in accordance with the requirements of 29 CFR Parts 1910, 1915, 1917, 1918, 1926 and 1928 - Hazard Communication Act, Final Rule (see 5.1).

3.8 Toxicity. The manufacturer shall certify that the enamel does not contain the following materials in excess of 0.06% by weight of the dry paint: asbestos or asbestos-form pigments, benzene, toluene, chlorinated solvents hydrolyzable chlorine derivatives, coal tar or coal tar derivatives, any ACGIH carcinogenic or ACGIH suspected carcinogenic compounds (see 3.5 and 3.7). The enamel shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this toxic effect shall be referred by contracting activity to the qualifying activity. The qualifying activity will act as advisor to the contracting activity. The qualifying activity will arrange for review of questions by the appropriate departmental medical service.

3.9 Material safety data sheet (MSDS). The contracting activity shall be provided a material safety data sheet at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification (see 6.7).

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- (a) Qualification inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

4.3 Qualification inspection. Qualification inspection shall be conducted at a laboratory satisfactory to NAVSEA. Qualification inspection shall consist of the tests specified in table V and paragraph 4.7. The enamel tested shall be drawn from regular production stocks. A test report detailing the results of any required testing performed by the manufacturer shall be provided.

4.3.1 Extension of qualification. Approval of qualification for Navy haze gray to match color 26270 of FED-STD-595 shall constitute approval for other colors of the same type and class. Approval of qualification for a type III class enamel shall also constitute approval of qualification of that enamel for types I and II of the same class. Approval of qualification for a type II class enamel shall also constitute approval of qualification of that enamel for type I of the same class. Enamel submitted for qualification for a type III, but passes the VOC requirement for type I and/or II shall be qualified for the same type I and/or II class provided that the enamel passes all other requirements for that type and class. Enamel submitted for qualification for a type II, but that does not pass the VOC requirement for type II, but passes the VOC requirement for type I, shall be qualified for the same type I class provided that the enamel passes all other requirements for that type and class.

TABLE VI. Tests.

	Requirements	Applicable test method FED-STD-141	ASTM test method	Test
Condition in container 1/	3.5.1	3011.2	----	4.6.1
Storage stability partially-full container	3.5.2.1	3021.1	D 1849	4.6.2
Storage stability - full container	3.5.2.2	----	D 1849	4.6.2.2
Dilution stability	3.5.3	4203.1	----	4.6.3
Accelerated storage stability	3.5.2.3	----	----	4.6.2.3
Brushing properties 1/	3.5.4	4321.2	----	4.6.4
Rolling properties 1/	3.5.5	4335	----	4.6.5
Spraying properties 1/	3.5.6	4331.1	----	4.6.6
Color 1/	3.3	----	D 2244	4.6.7
Odor	3.5.7	----	D 1296	4.6.8
Anchorage	3.5.8	----	----	4.6.9
Flexibility	3.5.9	6221	----	4.6.10
Flake and crack resistance	3.5.10	6304.1	----	4.6.11
Recoating	3.5.11	4061.2	----	4.6.12
Water resistance	3.5.12	----	----	4.6.13
Silica content 1/ 2/	Table IV	----	----	4.6.15.1
Copolymer 1/ 2/	3.4.1	----	----	4.6.15.2
Phthalic anhydride 1/ 2/	Table IV	----	D 563	4.6.14.1
Drying oil acids 1/ 2/	Table IV	----	D 1398	4.6.14.1
Gloss 60-degree specular 1/	Table V	----	D 523	4.6.16

See footnotes at end of table.

TABLE VI. Tests - Continued.

Requirements	Applicable test method FED-STD-141	ASTM test method	Test
Drying time 1/	Table V	----	4.6.17
Accelerated weathering	3.5.13	4061.2 D 523, D 569, D 2244, E 97, G 53	4.6.18
Soya oil 1/ 2/	Table IV ---- ----	D 2800 D 2245 D 1983	4.6.14.2 ---- ----
Phenolic resin 1/ 2/	Table IV	5141.1	4.6.14.2
Rosin 1/ 2/	Table IV	----	D 1542 4.6.14.2
Vehicle extraction	Table I	----	D 2698 4.6.14
Flash point 1/	Table V	----	D 3278 4.6.22
Water	Table V	---- D 95 or D 1364	4.6.22
Coarse particles 1/	Table V	4092.1	4.6.22
Consistency 1/	Table V	----	D 562 4.6.22
Fineness of grind 1/	Table V	----	D 1210 4.6.22
VOC 1/ 2/	Table V	----	4.6.19
Contrast ratio 1/	Table V	----	D 2805 4.6.22
Asbestos, soluble and total metals content 2/	3.2.1	----	4.6.20
Hazardous solvent content 2/	3.2.2	----	4.6.23
Long term exposure	3.5.14	----	4.6.21

1/ Quality conformance inspection test (see 4.4).

2/ By data certification

4.4 Quality conformance inspection. Quality conformance inspection shall consist of all tests specified in table VI with a footnote 1. Failure to pass any test and noncompliance with the requirements of section 3 shall be cause for rejection of the lot (see 6.3).

4.4.1 Definition of a lot. For the purposes of quality inspection and test sampling, a lot is defined as all the paint (in U.S. gallons) of the same type, class, grade, composition and color from a single uniform batch, produced and offered for delivery at one time. The addition of any substance to a batch shall constitute a new lot.

4.4.2 Sampling for quality conformance testing. As a minimum, the contractor shall select two samples of sufficient size to permit the performance of all the inspections and tests as specified in section 4. One sample shall be taken from the first 10% of production from the lot. The other shall be taken from the last 10% of production from the lot. If one or more defects are found in any sample, the entire lot represented by the sample shall be rejected. If a lot is rejected, the contractor has the option of screening 100% of the rejected lot for the defective characteristic(s) or providing a new lot which shall be inspected and tested in accordance with the procedures in section 4. The contractor shall maintain for a period of 3 years after contract completion, all records of inspections, tests, or any resulting rejections.

4.5 Test conditions. Unless otherwise specified, the routine and referee testing conditions shall be in accordance with section 9 of FED-STD-141. The term referee condition shall mean a temperature of  $23 \pm 1^\circ\text{C}$  ( $73 \pm 2^\circ\text{F}$ ) and a relative humidity of  $50 \pm 4$  percent. A dry film thickness of 3.8 to 5.1  $\mu\text{m}$  (0.0015 to 0.002 inches) shall be used whenever film thickness is requested in any test, unless otherwise required by the test. All paint test specimens shall be cured at least 16 hours at ambient laboratory conditions before testing unless otherwise specified.

4.5.1 Test panels and surface preparation. Unless otherwise specified, test panels shall be nominal 150 x 300 x 3 millimeter (mm) (6 x 12 x 0.25 inch) plate aluminum. Plates shall be abrasive blasted with aluminum oxide and solvent cleaned to provide a uniform, clean rough surface with a profile of 0.050 to 0.076 mm (0.002 to 0.003 inch) (nominal) on both sides.

#### 4.6 Tests.

4.6.1 Condition in container. The package condition on acceptance testing shall be determined in accordance with method 3011.2 of FED-STD-141 and observed for compliance with 3.5.1.

##### 4.6.2 Storage stability.

4.6.2.1 Partially-full containers. Skinning shall be determined after 48 hours in accordance with method 3021.1 of FED-STD-141, except that a 3/4 filled 1/2 pint multiple friction top can shall be used. The can shall be resealed and aged for 7 days at  $60^\circ\text{C}$  ( $140^\circ\text{F}$ ) and examined for compliance with 3.5.2.1.

4.6.2.2 Full container. A full quart can of enamel shall be allowed to stand undisturbed for 12 months and then the contents tested in accordance with ASTM D 1849. The contents shall be evaluated for pigment settling or caking as specified in 3.5.1, then agitate the can for 5 minutes on the paint shaker prior to re-examination. The viscosity shall be determined and other applicable tests made for compliance with 3.5.2.2.

4.6.2.3 Accelerated storage stability. After exposure to a temperature of  $60^\circ\text{C}$  ( $140^\circ\text{F}$ ) for a period of 30 days, a previously unopened, original container of enamel shall be examined for compliance with all the requirements of 3.5.2.3 and table VI with the exception of 3.2 and 3.5.14. The test results shall be in accordance with the requirements of this specification.

4.6.3 Dilution stability. One part by volume of enamel as packaged shall be reduced with one part by volume of thinner in accordance with TT-T-291, type I or III and tested in accordance with method 4203.1 of FED-STD-141 for compliance with 3.5.3.

4.6.4 Brushing properties. Brushing properties of the packaged enamel shall be determined in accordance with method 4321.2 of FED-STD-141 for compliance with 3.5.4. If a referee test is required, method 4494.1 of FED-STD-141 shall be used except that the drawdown shall be made a minimum of 25 centimeters (cm) (10 inches) long on a clear glass plate. Contact of the 102  $\mu\text{m}$  (4 mil) strip with the next thicker strip at any point within the 14 cm (5.5 inch) central portion of the blade path shall be an indication of sagging.

4.6.5 Rolling properties. Rolling properties of the enamel shall be determined in accordance with method 4335 of FED-STD-141 for compliance with 3.5.5.

4.6.6 Spraying properties. The enamel shall be sprayed on a steel panel to a dry film thickness of 23 to 28  $\mu\text{m}$  (0.0009 to 0.0011 inch). The panel shall be observed for spraying properties in accordance with method 4331.1 of FED-STD-141 to determine compliance with 3.5.6.

#### 4.6.7 Color testing.

4.6.7.1 Instrumental color deviation determination. Test specimens shall be prepared in accordance with ASTM D 823 Methods C or E using a nominal 0.006 inch blade film applicator on to a clear plate glass of not less than 3/8 inch (nominal) thickness which has been ground to a uniform finish with 1F carborundum. The color deviation shall be determined in accordance with ASTM D 2244 using an instrument having a  $D_{65}$  light source, a 45 degree illumination angle, and a 0 degree viewing angle. The instrument shall be calibrated in accordance with manufacturer instructions and shall be demonstrated to read the color of National Institute for Science and Technology (NIST [formerly National Bureau of Standards; NBS]) traceable standards with the color deviations of 3.3. After calibration of the instrument, measure the L, A, B color values of at least two FED-STD-595 color cards of the color being procured which were received from the Government not greater than 1 year prior to the date of this use. Calculate E for each color card. Determine the mean values of E, L, A and B for the color cards. These mean values will be used to calculate the color difference values. Measure the color values of the test enamel. Calculate the color deviation terms. If using an instrument that automatically calculates the color differences, enter the color card mean values as the base line for the color difference calculations. The results of the color deviation calculation shall be in accordance with the requirements of 3.3 or table VII, as applicable.

4.6.7.2 Referee color matching. If the enamel measured in accordance with 4.6.7.1 does not match the color card when visually examined, the discrepancy shall be resolved by an independent laboratory certified to the NIST National Volunteer Laboratory Accreditation Program for paint testing. When tested in accordance with ASTM D 823, the test enamel, prepared as specified in 4.6.7.1, shall visually match the FED-STD-595 color card that most closely corresponds to the mean values calculated in 4.6.7.1.

4.6.8 Odor. The enamel shall be tested for odor in accordance with ASTM D 1296 for compliance with 3.5.7.

4.6.9 Anchorage. A panel shall be prepared in accordance with method 4061.2 of FED-STD-141 and air-dried for 18 hours. The panel shall then be baked for 2 hours at  $105 \pm 2^\circ\text{C}$  ( $221 \pm 4^\circ\text{F}$ ). After baking, the panel shall be conditioned for 1 hour under referee testing conditions in accordance with section 9 of FED-STD-141, and a line scored through to the metal across the width of the film, using a sharp pointed knife. The film shall then be taped perpendicular to and across the score line with 25 mm (1 inch) (nominal, commercially available masking tape. The tape shall be pressed in firm contact with the test area, and approximately 10 seconds allowed for the test area to return to room temperature. The force end of the tape shall be grasped and stripped from the film by pulling it back at a rapid speed from the panel at an angle of approximately 180 degrees to determine compliance with 3.5.8.

4.6.10 Flexibility. The flexibility shall be determined in accordance with method 6221 of FED-STD-141. A 51 mm (2 inches) wide film applicator that will give a dry film thickness of 23 to 28  $\mu\text{m}$  (0.0009 to 0.0011 inch) on a smooth finish steel plate shall be prepared in accordance with method 2011.2 of FED-STD-141 using the aliphatic naphtha/propylene glycol monomethyl ether mixture. The panel shall be prepared from new cold rolled rust-free carbon steel  $25.4 \pm 2.5 \mu\text{m}$  (0.010  $\pm$  0.001 inch) thick with a Rockwell 15-T maximum hardness of 82 and shall be finished with a surface roughness of 8 to 12 microinches. The panel shall be air dried in a horizontal position for 18 hours and then baked for 168 hours at  $105 \pm 2^\circ\text{C}$  ( $221 \pm 4^\circ\text{F}$ ). The panel shall be conditioned for 1/2 hour under referee conditions and then bent over a 6.35 mm (0.250 inch) mandrel. The coating shall be examined for cracks over the area of the bend in a strong light at a 7-diameter magnification to determine compliance with 3.5.9.

4.6.11 Flake and crack resistance test. The knife test shall be performed in accordance with method 6304.1 of FED-STD-141 except that the knife may be a sharp razor, scalpel or commercial pocket knife using the flat portion of the panel from the flexibility test (see 4.6.10) to determine compliance with 3.5.10.

4.6.12 Enamel recoatability. Eight test panels of aluminum having nominal dimensions of 150 x 300 x 3 mm (6 x 12 1/8 inches) shall be prepared. The test requires 6 test panels. Test panels shall be degreased in accordance with methods B, C or D of ASTM D 609. The degreased test panels shall be abrasive blasted with new, clean aluminum oxide to provide a profile pattern of 0.0253 to 0.0506 mm (0.001 to 0.002 inch) (average). All test panels shall be primed with 2 coats of MIL-P-24441/20 or MIL-P-24441/29, type III or IV formula 150 green primer. Each coat of primer shall be applied to 0.051 to 0.101 mm (0.002 to 0.004 inch) dry film thickness and allowed to cure 24 hours at ambient laboratory conditions before being overcoated. Two coats of the test enamel shall be spray applied on the MIL-P-24441/20 and MIL-P-24441/29 formula 150 coated panels to obtain a final dry film thickness of the test topcoat of 101 to 151 mm (0.004 to 0.006 inch). Allow not less than 24 hours dry time between application of the coats of test topcoats at ambient laboratory conditions. The completed painted test panels shall be cured for not less than 7 days at ambient laboratory conditions before proceeding to the mounting on the test rack. Test specimens shall be mounted on a test fence having a 45° south facing rack at a distance of not greater than 30 meters (100 feet) of an ocean high tide line. The exposure shall be for a period of 1 year (365 days) in accordance with paragraph 6 of ASTM D 1014. The fence

shall be within the state of Florida, USA. After the exposure period of 1 year (365 days), the panels shall be returned to the laboratory. The panels shall be rinsed with cold tap water at nominal tap pressure for a period of 5 to 10 minutes without rubbing the surface in a manner that would disturb any chalking. The test panels shall then be dried for 24 hours at ambient laboratory conditions. The following overcoats shall be brush applied to 1/2 of each of two panels and the overcoated panels shall be cured for 48 hours at ambient laboratory conditions:

- (a) One coat of enamel, conforming with this specification, at a nominal wet film thickness of 76 to 101 mm (0.003 to 0.004 inch).
- (b) One coat of MIL-P-24441/20 or MIL-P-24441/29, type III or IV formula 150 at a nominal wet film thickness of 76 to 101 mm (0.003 to 0.004 inch).
- (c) One coat of TT-P-645 Navy formula 84 at a nominal wet film thickness of 76 to 101 mm (0.003 to 0.004 inch).

The adhesion between test coats shall be determined in accordance with the method described in 4.6.9. The adhesion and appearance shall conform to the requirements of 3.5.11.

4.6.13 Water resistance. A film of enamel shall be prepared by drawing down with a 51  $\mu\text{m}$  (0.002 inch) to 102  $\mu\text{m}$  (0.004 inch) gap clearance film applicator on a steel panel which has been solvent cleaned and phosphate coated in accordance with method 2011.2, procedure B of FED-STD-141, and shall be air dried for 7 days. Exposed uncoated metal surfaces shall be coated with wax or other suitable coating. The panel shall then be immersed in distilled water at  $23 \pm 1^\circ\text{C}$  ( $73 \pm 2^\circ\text{F}$ ) for 18 hours in accordance with ASTM D 1308. At the end of the test period, the panel shall be removed and examined for compliance with 3.5.12.

4.6.14 Vehicle extraction. The vehicle shall be extracted in accordance with ASTM D 2698.

4.6.14.1 Phthalic anhydride and drying oil acids. The unsaponifiable, drying oil acids and phthalic anhydride shall be determined on the isolated vehicle in accordance with ASTM D 1398 and D 563 respectively, except that the drying oil acids shall be extracted with the petroleum ether in place of chloroform and shall conform to table III.

4.6.14.2 Soya oil, phenolic resin, and rosin. The soya oil, phenolic resin, and rosin characteristics shall be determined as follows (see table VI):

<u>Characteristic</u>	<u>ASTM/Test method</u>
Soya oil	D 2800 D 2245 D 1983
Phenolic resin	Method 5141.1 of FED-STD-141
Rosin	D 1542

The soya oil, phenolic resin and rosin characteristics shall be in accordance with table IV.

4.6.15 Silicone-alkyd copolymer resin.

4.6.15.1 Silica content of vehicle. From a stoppered bottle or weighing pipet, the mass shall be accurately determined by difference, weigh approximately 3 grams of vehicle into a previously ignited and weighed 7.6 cm (3-inch) porcelain evaporating dish. Add 1 milliliter (mL) American Chemical Society concentrated sulfuric acid. The sample shall be dried at 110°C (230°F) (nominal) in an oven for 1 hour followed by one hour in an oven at 165°C (329°F) (nominal). The dried sample shall be placed in a cold muffle furnace and the temperature shall be gradually increased over a period of 3 hours to 800°C (1472°F). This temperature shall be maintained for an additional hour. After cooling in a desiccator, the mass of the dish and the contents shall be determined and the percent of silica shall be calculated as follows:

$$\text{Percent silica} = \frac{\text{Mass of ash} \times 100}{\text{Mass of sample} \times \text{nonvolatile fraction}}$$

The nonvolatile fraction has been determined in accordance with ASTM D 2369. The % silica shall be in accordance with the requirements of table IV.

4.6.15.2 Qualitative test for copolymer. The copolymer shall be tested qualitatively by agitating a 0.5 gram sample of the extracted vehicle with three successive 20 mL portions of isopropanol, decanting of the alcohol and saving each portion. The infrared spectrum shall be scanned from 2 to 15  $\mu\text{m}$  of a solvent-free film of both the isopropanol insoluble portion and the soluble portion after evaporation of the alcohol. The sample shall be checked for compliance with 3.4.1.

4.6.16 60-degree specular gloss. The thoroughly mixed enamel on plane, opaque, white glass panels as specified in Method 2021 of FED-STD-141. Use a film applicator which will produce a wet film thickness of 0.075 mm (0.003 inch). Dry 24 hours under referee conditions in a dust free environment. Paint specimen shall be dry hard before gloss test. Use longer cure time if required. When tested as specified in table VI, gloss shall conform to requirements of table V as applicable, for class specified.

4.6.17 Drying time. A film of enamel shall be prepared by drawing down a 0.075 mm (0.003 inch) film by using a 0.15 mm (0.006 inch) gap clearance with a film applicator, and the drying time shall be determined in accordance with method 4061.2 of FED-STD-141 under referee conditions for compliance with table V.

4.6.18 Accelerated weathering. The duplicate flat tin panels shall be prepared by drawing down films of enamel with a 0.15 mm (0.006 inch) gap clearance film applicator and allowing 7 days for complete cure. Air-dry for 168 hours. Measure the initial color of the test panel in accordance with ASTM E 97 on any suitable instrument. Measure the initial 60° gloss of the test panel in accordance with ASTM D 523. Expose the panels for 300 hours to accelerated weathering using Fluorescent UV-Condensation type apparatus in accordance with ASTM G 53. The cycle shall be 4 hours UV exposure using a UVB-313 bulb at 60°C (140°F) and 4 hours condensation exposure at 40°C (104°F). After exposure, remeasure color and gloss in accordance with ASTM E 97 and D 523. Calculate color difference in

accordance with ASTM D 2244 and calculate gloss change. The chalking shall be evaluated in accordance with ASTM D 659 and 60-degree gloss determined in accordance with ASTM D 523. The results shall be checked for compliance with 3.3 and 3.5.13.

4.6.19 VOC. VOC tests shall be conducted on enamel prepared for application in accordance with the manufacturer's ASTM F 718 data sheet. The VOC test shall be conducted in accordance with 40 CFR CH. 1, part 60, appendix A, (EPA) method 24 and checked for compliance with 1.2 and table V (see 6.3 and appendix).

4.6.20 Soluble and total metal content. Asbestos, soluble and total metal content, except tantalum and tungsten, shall be determined on a dry paint film of the enamels in accordance with the 40 CFR part 261, Appendix II, Toxicity Characteristic Leaching Procedure (TCLP) and the appropriate test listed below. Asbestos shall be analyzed in accordance with the method in the Federal Register, Volume 47, Number 103, Appendix A, pages 23376-23389, May 7, 1982 and test result reported as % by weight of the dry enamel film. Soluble metal content shall be reported as milligrams per liter (mg/L). Total metal content shall be reported as % by weight of the dry enamel film. The test results for asbestos or metal shall be in conformance with the requirements of 3.2.1 and tables I and II (see 6.3 and appendix A). Tantalum and tungsten soluble metal content and total metal content shall be analyzed as specified in 4.6.20.1.

Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846

<u>Metal/material</u>	<u>Digestion test method</u>
All metals, except Chromium (VI)	3050
Chromium (VI)	3060

<u>Metal/Material</u>	<u>SW-846 Analysis test method</u>
Antimony	7040 or 7041
Arsenic	7060 or 7061
Barium	7080 or 7081
Cadmium	7131
Total chromium	7190
Chromium (VI)	7195, 7196 or 7197
Lead	7421
Mercury	7470 or 7471
Nickel	7520 or 7521
Selenium	7740 or 7741
Silver	7760 or 7761

Methods for Chemical Analysis of Water and Waste, EPA-600/4-020, USEPA, 1979

<u>Metal/material</u>	<u>Test method</u>
Beryllium	210.1 or 210.2
Cobalt	219.1 or 219.2
Copper	220.1 or 220.2
Fluoride	340.1, 340.2 or 340.3
Molybdenum	246.1 or 246.2
Thallium	279.1 or 279.2
Vanadium	286.1 or 286.2
Zinc	289.1 or 289.2

4.6.20.1 Tantalum and tungsten content. Determine the tantalum and tungsten content of the enamel using any appropriate spectroscopy test method. Conduct the tests in accordance with the instrument manufacturer's directions for the use of the instrument. Manufacturer is responsible for establishing data supporting the test method choice and analytical accuracy. The test results for tantalum or tungsten shall be as specified in 3.2.1 and tables I and II (see 6.3 and appendix A).

4.6.21 Long term exterior exposure. Test panels shall be of aluminum having nominal dimensions of 150 x 300 x 3 mm (6 x 12 1/8 inch). Test requires 2 primed test panels. Test panels shall be degreased in accordance with methods B, C or D of ASTM D 609. The degreased test panels shall be abrasive blasted with new, clean aluminum oxide to provide a profile pattern of 0.025 to 0.076 mm (0.002 to 0.002 inch) (average). All test panels shall be primed with 2 coats of MIL-P-24441/20 or MIL-P-24441/29, type III or IV, formula 150 green primer. Each coat of MIL-P-24441/20 or MIL-P-24441/29, type III or IV, formula 150 shall be applied to 0.051 to 0.076 mm (0.002 to 0.004 inch) dry film thickness. Two coats of the test enamel shall be spray applied on the MIL-P-24441/20 and MIL-P-24441/29, type III or IV formula 150 coated panels to obtain a final dry film thickness of the test topcoat of 0.101 to 0.152 mm (0.004 to 0.006 inch). The test panels shall be cured for at least 24 hours dry time between application of the coats of test topcoats at ambient laboratory conditions. The completed painted test panels shall be cured for at least 7 days prior to mounting on the test rack. Test specimens shall be mounted on a test fence having a 45° south facing rack at a distance of not greater than 100 feet of an ocean high tide line. The exposure shall be in accordance with paragraph 6 of ASTM D 1014. The fence shall be within the state of Florida, USA. Prior to initiating the test, photograph the wall of the test panels (include a gray color scale in all photos and develop photographs to the scale). After a test period of 1 year (365 days), the test panels shall be examined in accordance with the following:

<u>Property</u>	<u>ASTM test method</u>
Color	E 97
Gloss - 60°	D 523
Chalking	D 4214, Fig. 2
Checking	D 660
Cracking	D 661
Blistering	D 714
Coloring difference	D 2244

The test results shall conform to the requirements of 3.5.14.

4.6.22 Quantitative tests. The enamel shall be tested for the quantitative requirements of table V as specified in 3.6 as follows (see table VI):

<u>Characteristic</u>	<u>ASTM test method</u>
Flash point	D 3278
Water	D 95, D 1364
Course particles	Method 4092.1 of FED-STD-141
Consistency	D 562
Fineness of grind	D 1210
Contrast ratio	D 2805

The measured characteristic values shall be in accordance with the requirements of table V.

4.6.23 Hazardous solvent content. Hazardous solvent content shall be determined in accordance with Methods 7356 and 7360 of FED-STD-141. Solvent fractions shall be identified in accordance with ASTM E 1252. Test results shall be reported as % by weight of the total enamel. The test results for each solvent shall be in accordance with the requirement in 3.2.2 and table III (see 6.3 and appendix A).

4.7 Toxicological product formulations. The contractor shall have the toxicological product formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use.

4.8 Inspection of packaging. Sample packs, and the inspection of the preservation, packing and marking for shipment, stowage and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

## 5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 Packaging requirements. The enamel shall be package level A, B, or C, packed as specified (see 6.7) and marked in accordance with PPP-P-1892, herein and shall include bar codes, hazardous warnings (see 3.7) and applicable packaging acquisition options therein specified (see 6.2). The enamel shall be furnished in 3.78-liter (1-gallon) cans or 19-liter (5-gallon) pails as specified (see 6.2). In addition for Navy acquisitions, the following Navy fire-retardant requirements apply:

(a) Treated lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood, including laminated veneer materials, used in shipping container and pallet construction, member, blocking, bracing, and reinforcing shall be fire-retardant treated materials in accordance with MIL-L-19140 as follows:

Levels A and B: MIL-L-19140, type II (weather resistant), Category I - general use.

Level C: MIL-L-19140, type I (non-weather resistant), Category I - (general use).

(b) Fiberboard. Fiberboard used in the construction of interior (unit and intermediate) and exterior containers, including interior packaging forms, shall conform to the PPP-F-320. PPP-F-320 classes shall be domestic fire-retardant or weather resistant fire-retardant as specified (see 6.2).

5.1.1 Special marking. In addition to other markings required on the containers, enamels shall be marked as follows: "Contains (Insert VOC level for type here) grams per liter of volatile organic content per 40 CFR CH.1, part 60, appendix A (EPA) method 24.

5.1.2 Shelf life marking. In addition to other markings required on the containers, enamels shall be marked as follows:

- (a) "Contains (Insert VOC level for type here) grams per liter of volatile organic content per 40 CFR CH.1, part 60, appendix A (EPA) method 24."
- (b) Manufacturer's lot or batch number.
- (c) Date of manufacture and reinspection date (24 months).
- (d) Instructions for use and storage, i.e. thinning, mixing, storage requirements, etc. on unit container.

5.1.2 Shelf life marking. In addition to markings specified in 5.1 and 5.1.1, each unit container, intermediate container where applicable, and shipping container shall be marked as follows: "Date of first reinspection (insert date 1 year after date of manufacture)".

5.1.3 Precautionary markings. In addition to the markings in accordance with 29 CFR Parts 1910, 1915, 1917, 1918, 1926 and 1928, as well as PPP-P-1892, all individual containers shall have the following markings:

"CAUTION: This enamel contains volatile solvents, with probable hazardous vapors. Use with adequate ventilation. Avoid prolonged breathing of vapors or spray mists. The solvents are highly flammable, avoid open flame and smoking."

5.2 Material safety data sheets (MSDS). A copy of the MSDS shall be attached to the shipping document for each destination (see 3.9).

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This specification covers high grade, air-drying enamels made from a copolymer of long-oil soya alkyd and silicone resins and is intended for use on primed metal, particularly on smooth, exterior metal. It is highly weather-resistant and is characterized by excellent color and gloss retention, good drying, freedom from aftertack and good flexibility. The enamel may be applied with brush, roller or spray.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification.
- (b) Type required (see 1.2).
- (c) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- (d) When qualification is required (see 3.1).
- (e) Color, class, and number of enamels recommended (see table VI).
- (f) Level of packaging, level of packing and packaging acquisition option(s) required (see 5.1).
- (g) When fire retardant treated lumber and plywood is not required (see 5.1(a)).

- (h) Class of fire retardant fiberboard required (see 5.1(b)).
- (i) Size of container required (see 5.1).
- (j) Required marking (see 5.1.1, 5.1.2 and 5.1.3).

TABLE VII. FED-STD-595 Color numbers and descriptions. 1/ 2/ 3/

Gloss	Semigloss	Low gloss lusterless	Word description
10080	---	---	Brown (piping and valve marking)
---	*20109	30109	Brown (20109 for replacement of DOD-E-18210 formula 23)
---	20117	30117	Brown
10324	---	---	Tan (piping and valve marking)
10371	---	---	Spar (U.S. Coast Guard)/Buff (piping and valve marking)
11105	---	---	Red (piping and valve marking)
11120	---	---	Red (OSHA safety color)
11136	21136	31136	Red (Insignia red)
12197	---	---	International orange
12199	---	---	Red (U.S. Coast Guard)
12246	---	---	Orange (piping and valve marking)
12300	---	---	Orange (OSHA safety color)
13538	---	---	Yellow (piping and valve marking)
13591	---	---	Yellow (OSHA safety color)
13655	23655	33655	Yellow
---	23814	---	Chartreuse (piping and valve marking)
14062	---	---	Dark green (piping and valve marking)
14097	24097	*34097	Dark green (34092 for replacement of DOD-E-18214 formula 19)
14120	---	---	Green (OSHA safety color)
14449	---	---	Light green (piping and valve marking)

See footnotes at end of table.

TABLE VII. FED-STD-595 Color numbers and descriptions. - Continued 1/ 2/ 3/

Gloss	Semigloss	Low gloss lusterless	Word description
15042	25042	35042	Blue (Sea blue)
15044	---	---	Dark blue (piping and valve marking)
15048	25048	35048	Blue (Insignia blue)
15092	---	---	Blue (OSHA safety color)
15102	25102	---	Blue (Light blue)
15182	---	---	Blue (U.S. Coast Guard)
15200	---	---	Light blue (piping and valve marking)
---	*26008	---	Gray (26008 for replacement of DOD-E-699 formula 20)
16081	---	---	Dark gray (piping and valve marking)
16099	---	---	Deck gray (U.S. Coast Guard)
---	26118	*36118	Gray # 11 (36118 for replacement of DOD-P-15183 formula 109)
---	*26173	36173	Gray # 17 (Ocean gray)
16187	---	---	Gray (piping and valve marking)
---	26231	*36231	Gray # 23 (36231 for replacement of DOD-E-700 formula 20L)
---	*26270	36270	Gray # 27 (Haze gray; 26270 for Navy semigloss requirements)
16307	*26307	36307	Gray # 30 (Bulkhead gray)
---	*26373	36273	Gray # 37
16376	---	---	Light gray (piping and valve marking)
16492	*26492	36492	Gray # 49 (Gull or Pearl Gray)
17038	*27038	37038	Black (27038 for replacement of DOD-E-698 formula 24; 37038 for replacement of DOD-P-15146 formula 104) (piping and valve marking)

See footnotes at end of table.

TABLE VII. FED-STD-595 Color numbers and descriptions. - Continued 1/ 2/ 3/

Gloss	Semigloss	Low gloss lusterless	Word description
17043	---	---	Gold (piping and valve marking)
17100	---	---	Dark purple (piping and valve marking)
17142	---	---	Light purple (piping and valve marking)
17155	---	---	Purple (OSHA safety color)
17875	*27875	37875	White (Insignia white - 27875 matches color of DOD-E-1115 formula 30)
17886	27886	37886	White (bone white) (piping and valve marking)

1/ See FED-STD-595 for color cards.

2/ \* mark Navy colors.

3/ Table VII provides FED-STD-595 color numbers and descriptions for commonly specified colors. To order colors not listed, the contracting officer shall provide FED-STD-595 color number or other information necessary to identify the product desired.

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.4	DI-NDTI-80809	Test reports	-----
4.6.19 and appendix A	DI-MISC-80678	Certification/ data report	-----

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List No. 24635 whether or not such products have actually been listed by that date. The attention of contractors is called to these requirements, and manufacturers are urged to have the products that they propose to offer to the Federal Government tested for qualification in

order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Sea Systems Command, SEA 03R42, 2531 Jefferson Davis Hwy., Arlington, VA 22242-5160 and information pertaining to the qualification of products may be obtained from that activity.

6.5 Unit of procurement. The paint covered by this specification should be purchased by volume, the unit being 1 liter or 1 U.S. liquid gallon at 15.5°C (60°F).

6.6 Volatile content. Although the container marking specifically refers to Federal regulations, the paint may be used anywhere else a product complying with 1.2 is allowed. This includes other air pollution control districts or similar areas controlling the emission of solvents into the atmosphere.

6.7 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.8 Directions for use. The manufacturer must provide written directions for the mixing and applying of the enamel supplied and this direction shall include all information necessary to comply with OSHA Hazard Communication Act and FED-STD-313. In addition, the manufacturer must prepare an ASTM F 718 data sheet which separately details requirements for small unit (pint, quart, gallon) and large unit (5 gallon) containers.

6.9 Subject term (key word) listing.

- Alkyd
- Flat
- Gloss
- Low-gloss
- Non-lead
- Paint
- Semi-gloss
- Topcoat
- Volatile organic content

6.10 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity:  
Navy - SH  
(Project 8010-N519)

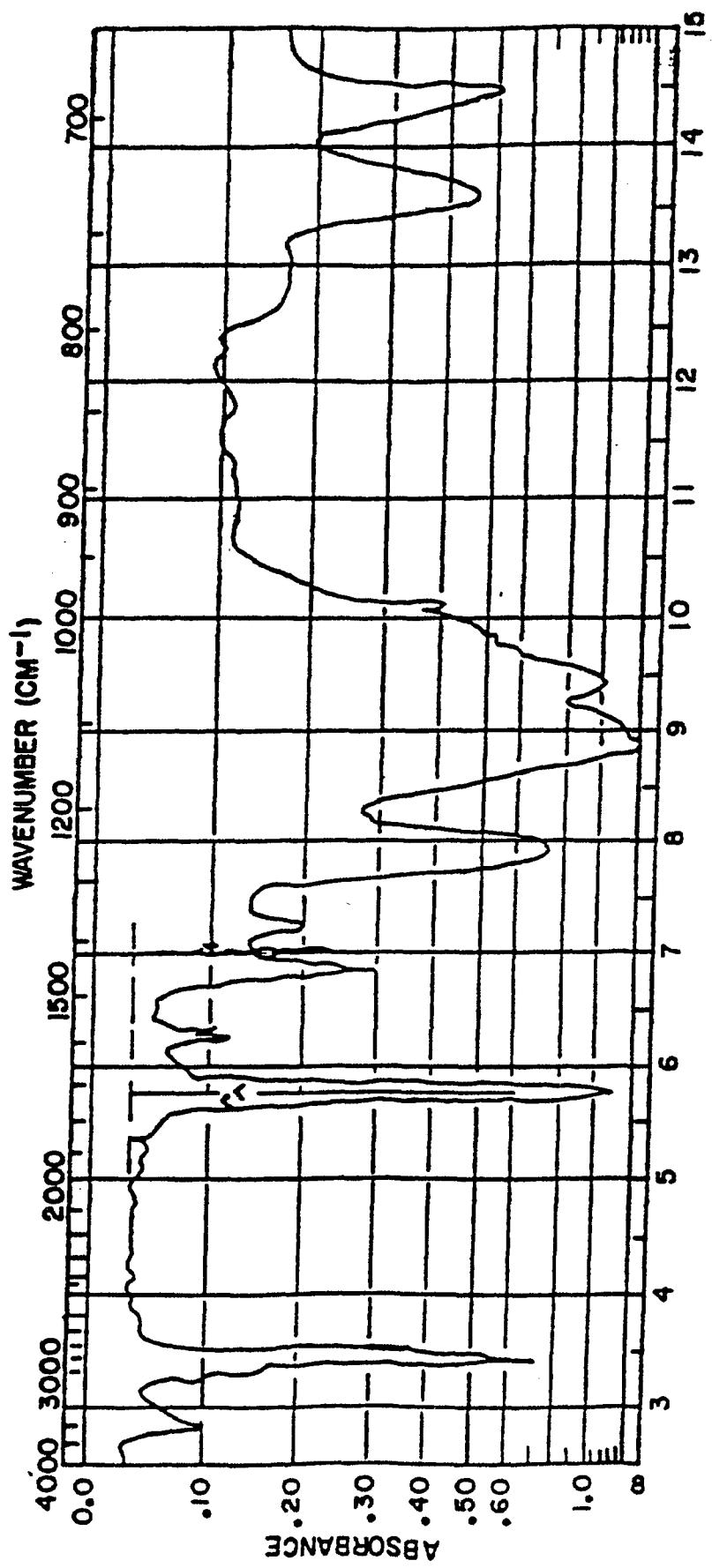


FIGURE 1. Wavelength (micrometers).

## APPENDIX A

## CERTIFICATION/DATA REPORT TECHNICAL CONTENT REQUIREMENTS

## 10. SCOPE

10.1 Scope. This appendix covers the content requirements of the certification to accompany each lot of enamel submitted for Government acceptance. This appendix is mandatory only when data item description DI-MISC-80678 is cited on the DD Form 1423.

## 20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

## 30. TECHNICAL CONTENT REQUIREMENTS

30.1 Certificate of compliance. The certificate of compliance shall include separate and specific statements by the contractor that:

- (a) The VOC conforms to the requirements of the enamel as specified in table V.
- (b) The lead, chromium, chromium (III), chromium (VI), tantalum, tungsten and asbestos content conforms to the requirements of the enamel as specified in tables I, II and V.
- (c) Silica content, copolymer, phthalic content, drying oil acids, soya oil, phenolic resin and rosin conform to the requirements of the enamel specified in table IV and 3.4.1.
- (d) The hazardous air pollutant content conforms to the requirements for the enamel specified in table III.

**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL****INSTRUCTIONS**

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the comment number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of this form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

<b>I RECOMMEND A CHANGE:</b>		1. DOCUMENT NUMBER MIL-E-24635B(SH)	2. DOCUMENT DATE (YYMMDD) 940630
<b>3. DOCUMENT TITLE</b> <b>ENAMEL, SILICONE ALKYD COPOLYMER (METRIC)</b>			
<b>4. NATURE OF CHANGE</b> (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)			
<b>5. REASON FOR RECOMMENDATION</b>			
<b>6. SUBMITTER</b> a. NAME (Last, First, Middle Initial)		b. ORGANIZATION	
c. ADDRESS (Include Zip Code)		d. TELEPHONE (Include Area Code) (1) Commercial (2) DSN (If applicable)	e. DATE SUBMITTED (YYMMDD)
<b>8. PREPARING ACTIVITY</b> a. NAME Technical Point of Contact (TPOC) MS. BRENDA HOLMES, SEA 03M1 ADDRESS ALL CORRESPONDENCE AS FOLLOWS:		b. TELEPHONE (Include Area Code) (1) Commercial: DSN: TPOC: 703-602-0216 X123 8-332-0216 X123	
c. ADDRESS (Include Zip Code) COMMANDER, NAVAL SEA SYSTEMS COMMAND ATTN: SEA 03R42 2531 JEFFERSON DAVIS HIGHWAY ARLINGTON, VA 22242-5160		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403 Falls Church, VA 22041-3466 Telephone 703-756-2340 DSN 289-2340	